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THE FORMATION OF VOICELESS CONSONANTS IN FRENCH AND ENGLISH

It is instructive to note the different manner in which the French and English employ the lips in pronouncing words like *bow, beau; few, feu;* etc. In English, the lips, not being required in advanced position for the production of the consonant, are close against the gums for *b* and *f* and, following the explosion of the consonant, advance slowly into the forward position required by the vowel. This slow changing movement renders the production of a pure vowel impossible. The French manner is quite different: in order to facilitate the rapidity of transition from consonant to vowel, the consonant is pronounced with the lips anticipating the position requisite for the vowel: thus, in *beau,* the lips are advanced before pronouncing *b,* in such manner that during the explosion of the *b,* as a result of a slight separation, they assume the position for *ó*(*eau*).

This preparation of the vowel before pronouncing the preceding consonant is not confined to the action of the lips alone. In the production of the voiceless consonants, the vocal cords may be in a state of relaxation leaving a large V-shaped opening through which the air may pass, or on the contrary, the vocal cords may be under tension and partly closed in preparation for the following vowel.

If *fine* and *vine* are pronounced one after the other, holding the back of the hand half an inch in front of the mouth, a much stronger current of air is felt accompanying the explosion of the *f* than of the *v*. The vocal cords are relaxed and wide open for the *f* and considerable time is required to change from this open position to the narrow slit necessary for the production of the following diphthong; but *v* in *vine* being a voiced consonant, the vocal cords form a narrow slit during its production as well as during the articulation of the following diphthong. With the same pressure exerted on the air in the lungs, much air may pass through the large opening of the vocal cords for *f* and relatively little through the narrow slit for *v*.

When *f* and *v* are pronounced by a Frenchman, there is little or no appreciable difference in the amount of air accompanying their production. As with the lips in the pronunciation of *beau,* the Frenchman anticipates the following vowel with the vocal cords in such manner as to permit of a rapid transition from consonant to vowel: the cords are under tension and the opening is narrowed as much as possible without causing the voiceless consonant to go over into the corresponding voiced consonant.

English-speaking people may try the following experiment: pronounce *fine* and *vine* noticing with the back of the hand the difference in the volume of air emitted during the production of each; then, prepare to pronounce *vine* until a feeling of tension and muscular effort is felt in the larynx; maintain this feeling of tension and pronounce *fine.* The "breathiness" of the *f* will have disappeared. The same experiment with *b, p; d, t; g, k; j, ch; z, s;* is equally successful.

Nevertheless, a certain amount of breath accompanies the production of the French voiceless consonants and from a comparison of the tracings for French *face* (Fig. 1*a*) pronounced by Mr. Paillard and English *face* (Fig. 1*b*) by Mr. Bovée (American), or of *théâtre* and *theater*[1] or of *tremble* (Fig. 2*a*) pronounced by Mr. Paillard and English *tremble* (Fig. 2*b*), it will be seen that the difference in the amount of the explosion in French and English is not always very appreciable. Usually, however, the explosion is not so marked in French (cf. Figs. 3, *cette,* Abbé Rousselot, and 4, *sage,* Mr. Jackson; 5, *fermer,* Abbé Rousselot, and 6, *former,* Mr. Jackson; 7*a, tome,* Mr. Lote, and 7*b, tome,* Mr. Jackson; 8*a* [il se] *couche,* Mr. Paillard; and Fig. 8*b, couch,* Mr. Bovée), and it never lasts so long. If the enunciations are equally energetic, the explosion accompanying voiceless consonants is stronger and lasts longer in English than it does in French.

The experiment frequently recommended of holding a lighted match in front of the lips to test for French *p, t, k* is worthless. By pronouncing gently, an American may retain the English arrangement of the vocal cords and yet not blow out the match; on the other hand, a Frenchman pronouncing with some little force,[1] will extinguish the match. The result, as long as the American pronunciation is gentle, is a fair counterfeit of the French, but in reality nothing is changed by this exercise and in a normally energetic pronunciation the characteristic aspiration remains audible.

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[1] See my article, *Modern Philology,* Vol. XIX, No. 3, pp. 332, 333, figures 19, 20.

The aspiration of *f*, *s*, *ch* is less noticeable than that of *p*, *t*, *k* since in pronouncing *s* or *ch* or *f* little air can pass through the comparatively small opening between tongue and palate or lower lip and upper teeth.

According to Klinghardt:

> All Frenchmen pronounce initial *p*, *t*, *k* without "hauch" [breathiness] and final *p*, *t*, *k* with "hauch," and form *p* in such manner that the explosion of the lips is brought about by an upward movement of the closed glottis, the vocal cords passing in the syllable *pa* from a position of complete closure for *p* to that of a narrow slit for *a* so that so little "lung" air may escape as to make the formation of a "hauch" [breathiness or noticeable explosion after the consonant] impossible; on the other hand, in the syllable *ap*, the vocal cords are not prevented as they open from the closed *p* position from assuming their normal position, but before this position is reached sufficient air escapes to form "hauchgeräusch" in the mouth; this "hauchgeräusch" is of relatively short duration because of the fact that the "sprechmechanismus" instinctively regards its task as accomplished with the completion of the *p*-explosion, stops any special pressure on the air [in the lungs] and passes over to normal breathing![2]

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[1] "C'est avec le plus grand intérêt que j'ai lu l'article de Klinghardt sur ce sujet dans les *Neuere Sprachen* de mai. Aussitôt lu, j'ai voulu répéter les expériences dont il parle. Et ... je ne suis pas arrivé au même résultat!

La chose n'est pas nouvelle. En 1900, j'ai vu Klinghardt et Walter chercher à rendre sensible la différence entre la syllabe qui est en allemand et en français, en tenant une allumette allumée devant leur bouche: l'allumette continuait à brûler avec un *p* français, s'éteignait avec un *p* allemand. Enchanté je rentre chez moi, j'enflamme une allumette, je la mets devant ma bouche, je pronounce *pa* à la française: l'allumette s'éteint. Je recommence dix fois, vingt fois, mon allumette s'éteint toujours. Je suis forcé de conclure que le "*p* français" de mes amis allemands est sensiblement différent du mien, et probablement n'est pas un *p* français, bien qu'à l'oreille il y ressemble beaucoup."—Paul Passy, *Neuere Sprachen*, July, 1906, p. 253.

[2] "Jedermann weiss, dass die französischen Tenues von den deutschen verschieden sind; jedermann weiss auch, dass der unterschied der bildung und lautwirkung beider konsonantengruppen darin besteht, dass die explosion, welche deutsche wie französische *p*, *t*, *k* kennzeichnet, im deutschen von nach folgendem hauch begleitet ist, im französischen aber nicht."

"1. Deutsch. Wenn ich die deutschen silben, *p*, *t*, *k* bilde, so steht im augenblick vor der explosiven 'öffnung' der anlaute [*p*, *t*, *k*] der ganze weg von den luftgefüllten lungen bis zur stelle des lippen—bzw. zungenschlusses vollständig offen: die stimmlippen [stimmbänder] des kehlkopfes sind weitauseinander gesperrt. Durch muskeldruck auf

If this theory of the production of *p, t, k* were true, the tracings should show a marked explosion after end consonants, but little or none after beginning consonants. This is not the case. In a pronunciation lacking in energy, the final explosion may be scarcely discernible on the tracing, and the explosion after a beginning consonant is often very marked; in no case is there anything to indicate that the nature of the explosion of beginning French *p, t, k* is different from that of final *p, t, k*. Again the theory that the glottis is entirely closed during the production of *p, t, k* (French) accounts neither for the duration nor the force of the aspiration in an energetic pronunciation.

The true explanation of the final explosions is found in the fact that all end consonants in English and in German are "final" consonants; that is, they are pronounced by means of a preceding vowel; and that all end consonants in French are "initial"; that is, they are

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die lungen treibe ich luft nach oben, gegen die schlussstelle hin, der schluss wird gesprengt, und die unter genanntem druck ausströmende luft bringt solange an den wänden des kehlkopfes, des rachens und des mundes reibegeräusch ['hauch'] hervor, bis die behufs bildung des stimmtons für *a* rasch sich einander nähernden stimmlippen 'tonlage' erreicht haben, und durch die zwischen ihnen verbleibende ritze ['stimmritze'] nicht mehr luft genug dringen kann, um noch wie vorher, reibegeräusch in rachen und mund zu erzeugen. Man sieht: bei solcher articulation *muss* notwendig zwischen dem augenblick der explosion und dem anschlag des *a*-tons 'hauch' entstehen.

"2. *Französisch.* Bei bildung der französischen silben *pa, ta, ka* dagegen ist der luftweg zwischen lunge und schlussstelle des mundes durch vollständigen schluss des kehlkopfes mittelst der fest aneinander gelegten stimmlippen *unterbrochen.* Daher kann die explosion auch nicht durch muskeldruck auf die lungen und druck der so nach oben ausgetriebenen lungenluft erfolgen, sondern sie wird auf anderem wege bewirkt. Es ist nämlich der kehlkopf unter anderem auch mittelst der muskelbündel der zu beiden seiten des zäpfchens [uvula] nach sich hinabziehenden 'gaumenbogen' am schädel [zunächst am 'weichengaumen'] aufgehängt. Verkürzt man diese muskelbündel durch zusammenziehung, so wird dadurch der [geschlossene!] kehlkopf ein wenig nach oben gezogen. . . . . Diese pressung der mundluft äussert sich in druck auf den letztgenannten schluss und bewirkt explosive lösung desselben; reibegeräusche bildende lungenluft *kann gar nicht nachstürzen,* da im augenblick der explosion der kehlkopf noch geschlossen ist und auch nach seiner öffnung sich nur bis auf den durchmesser der zur bildung des stimmtones für *a* notwendigen 'stimmritze' öffnet. Durch diesen winzigen spalt kann, noch bevor die rhythmischen schwingen für *a* einsetzen, schlechterdings nicht so viel luft ausströmen, das dadurch reibegeräusch in den weiten räumen des rachens und des mundes erzeugt würde.

"Die vollständige wesensverschiedenheit der deutschen und der französischen artikulation bei der bildung von *p, t, k* besteht also darin, dass bei deutscher aussprache durch druck auf die lungen lungen luft durch den offenen kehlkopf nach aussen getrieben wird, bei französischer aussprache aber durch hebung des geschlossenen kehlkopfs mund- (und rachen-) luft nach aussen stürzt. Der druck der letzteren ist natürlich *augenblicklich erschöpft,* der dem grossen luftreservoir der lungen entstammende kann lange anhalten."—H. Klinghardt, "Die verschiedene Bildung der Tenues im Französischen und Deutschen," *Neuere Sprachen,* Mai 1906, Band XIV, Heft 2.

pronounced by a following explosion or indistinct "voiceless" or "voiced" vowel.[1] It is owing to this that final *p, t, k* (*s, sh, f*) in English, though marked by a strong aspiration when they begin a syllable, are not "breathy" at the end of a word, and that in French, *p, t, k* (*s, ch, f*) at the end of a word are accompanied by a distinct explosion.

MECHANISM AND POSITION

The great similarity of differences between French sounds and English sounds indicates the probability of a single cause determining the variations in the treatment of diphthongs, in the earlier functioning of the vocal cords during the production of consonants, and the differences in the length of consonants and in the position of consonants and vowels.

The French manner of pronouncing *bel* is conducive to the production of a pure vowel since the stoppage of breath and the relative

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To Klinghardt's explanation that the entire difference in the German (English) and French articulation of *p, t, k* consists in the fact that in the German articulation air from the lungs is driven through the open glottis and that in the French pronunciation through raising of the closed larynx air is forced out of mouth (and throat), the air from the lungs lasting a long time, but the air from the mouth and throat being immediately exhausted, Paul Passy objects: "Au point de vue de l'investigation scientifique je crois que la question mérite d'être élucidée. Il y a d'abord un point à noter, c'est que les plosives *finales* sont assez fortement aspirées en français, dans des mots comme *cap, nette, roc;* Klinghardt ne paraît pas y avoir réfléchi, je ne sais pas trop comment ça cadre avec sa théorie."—*Neuere Sprachen*, Mai 1906.

And Klinghardt replies: "P. hat gewiss recht: alle franzosen sprechen ihre anlautende *p, t, k* ohne hauch, ihre auslautenden mit hauch. Warum *muss* das so sein bei einer artikulation, wie ich sie auf ihrer seite annehme? Nun, wenn sie wirklich, wie ich meine, ihre *p* so bilden, dass sie die lippenexplosion durch emporrucken des geschlossenen kehlkopfes herbeiführen, so können eben bei ihnen die *chordae vocales*, wenn dieselben in der silbe *pa* von der zu *p* gehörigen schlussstellung übergehen zu der von *a* bedingten parallelstellung [so eng aneinander, dass berührung nur ausgeschlossen ist], bloss so wenig 'lungen'-luft austreten lassen, dass von einer *hauch*bildung keine rede ist. Dagegen in der silbe *ap* werden die *ch. v.* bei ihrer öffnungsbewegung nach der explosion des *p* durch nichts gehindert, dieselbe bis zu ihrer normalen atmungsweite auszuführen; aber noch bevor diese erreicht ist, tritt von allein überreichlich und mit hinreichendem druck luft aus, um im mundraume hauchgeräusch zu bilden. Dass dieses relatif schnell aufhört, hat seinen grund darin, dass der sprechmechanismus instinktiv mit ausführung der *p*-explosion seine aufgabe für erledigt ansieht, jede besondere druckanstellung einstellt und zur regelmässigen atmung übergeht.

"Also der von mir geschilderte mechanismus der *p*-artikulation schliesst bei unmittelbarer nachfolge von *a* [*pa*] die möglichkeit der hauchbildung oder aspiration aus, kann aber bei unmittelbarer nachfolge von regelmässiger atmung [*ap*] die entstehung eines hauchgeräusches gar nicht verhindern. Und damit, scheint mir, habe ich den von P. an *cap, nette, roc,* geknüpften einwand erledigt."—Klinghardt, *Neuere Sprachen*, 1906, p. 312.

[1] See my article, *Modern Philology*, Vol. XIV, pp. 93–102.

pause after the *e* make any change of position during the production of the vowel in anticipation of the following consonant unnecessary. The English manner of pronouncing "final" consonants makes the production of diphthongs inevitable. Since end consonants in English are produced by means of the preceding vowel, there is always a movement of closure during the production of a vowel followed by a consonant in the same syllable, and this habit of closure persists even when the vowel is final or in the pronunciation of a series of the same vowel; it is this combination of gradual change of position and continued production of sound that characterizes the true diphthong as opposed to the French variety consisting of a semi-consonant followed by a pure vowel.

It has been observed that the vocal cords vibrate in French during the tension of *b*, *g*, *d* and all voiced consonants. The pronunciation of these consonants begins while the position of tension is being held, and by a comparison of figures 17, 18, 19, 21, and 22 (*Modern Philology,* Vol. XIX, pp. 331, 332, 333, and 334) it will be seen that the positions for the consonants are held much longer in French than in English. It is evident also from a comparison of figures 1, 2, 5, (*Modern Philology,* Vol. XIX, pp. 322, 323, 325, and 331) that the voiceless consonants in general are held a length of time equal to that of the corresponding voiced consonants. In the case of the continuants, the consonant is prolonged or "vocalized"; in the case of the explosives *p, k, t* the position of closure is held in silence some time before the explosion of the consonant takes place. In the production of English voiced consonants, the beginning of the vibration of the vocal cords is almost simultaneous with the leaving of the consonant position; voiceless consonants, even the continuants are not prolonged, but the position of tension is left immediately (cf. English *sh* and French *ch* as in *shall* and *chaque*). Because of the continuous pronunciation of English, a consonant between two vowels as *l* in *follow* is only a point of transition and because of this transition or movement, the consonant position of closure is held but a short time or in reality is not held at all since there is continual change of position; on the other hand, the French mechanism with its pause and stoppage of breath before consonants lends itself to the holding of the consonant position and the consequent lengthening of the consonant.

Moreover in a great number of consonant groups, the English manner of pronouncing an end-consonant (as a "final" consonant) after a vowel brings about a shortening of the consonant; this short consonant, in the majority of cases a necessary product of the mechanism, comes to be used everywhere. Thus in the word *somebody*, the English speaking person pronounces the *m* with the vowel *o* of *some* as he closes his lips, and then pronounces the *b* with the vowel *o* of *body* as he opens his lips. In order to pronounce both *m* and *b*, the American makes but one movement of opening and closing the lips. A Frenchman must close and open his lips for *m* and then must close and open them again for *b*. It is evident that if the movements are made at the same rate of speed, the French consonants are twice as long as the English consonants.

A comparison of French and English vowels and consonants reveals striking common differences: front vowels, *i*, *é*, *è* are pronounced with the tongue in a more forward position in French than in English—in pronouncing open *è*, for example, the point of the Frenchman's tongue is very close to the front lower teeth, the Englishman's tongue in pronouncing the corresponding sound of "short *e*" is withdrawn a quarter of an inch or more in the mouth. This may be observed with the eye without the aid of the artificial palate. The back vowels *u* and *o* are more closed and produced with the point of the tongue farther back in French than in English.

The position for *g* and *k* is farther forward in English than in French, and the position for *t*, *d*, *n*, *l*, *ch* (English *sh*), *j* (English *zh*), is farther back in English than in French.

Is this similarity of differences accidental? In pronouncing *peck*, the tongue assumes position against the palate for *k* while the vowel *e* is still being produced, the *k* position is thus taken by the tongue without entirely relinquishing the position for *e*—the tongue attempts to adapt itself to the position of vowel and consonant simultaneously, and as this is physically impossible, the *k* shifts forward and the *e* back. In like manner, in *bowl*, the tongue assumes the *l* position while still striving to maintain the *o* position and in consequence the *o* is shifted forward, is not as closed, and the *l* is produced farther back.

In French, the jaws are separated during the pronunciation of the medium *o* of *bonnet*, but the jaws are nearly closed again before placing the tongue in position for *n* and, without effort, the tongue takes a forward position for the consonant; in English *bonnet*, because the *n* is pronounced by means of the preceding *o*, the tongue must take position for the consonant while the jaws are still separated for the vowel. In French, the tongue in position for *n* may be said to form the hypothenuse of a right-angled triangle having a long base and a short side; in English, because of the separation of the jaws, the side of the triangle is lengthened, thus increasing the length of the hypothenuse. The English mechanism does not permit of the shortening of the side of the triangle as in French, but it does permit of the shortening of the base and the consequent shortening of the hypothenuse and this is done by the tongue taking position for the *n*, not on the teeth, but back of them on the hard palate, and any unusual muscular effort on the part of the tongue is thus avoided.

The explanation of the differences in position of the other vowels and consonants is the same as given for *e* and *o*, *l* and *n*.

Such differences of position do not account for the acoustic differences of the consonants; the positions noted by the phoneticians are static or rather only points in a multitude of positions of movement and do not take into account how the positions are reached and left or how the breath is used during this movement, and any one of the neglected points of movement is just as important as the positions noted. As static positions they have little or negligible importance and are not fundamental but incidental and are determined by the control of the breath and the closely related general movement or mechanism. These positions are not a cause but a result.

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